Action objects to the failure of the Information Disclosure Statement to include a Form PTO-1449.

Further to telephone discussions with the Examiner on February 6 and February 7, 2006, a copy of the Form PTO-1449 submitted with the IDS filed November 2, 2005 is submitted with this Response, along with a U.S. Patent and Trademark Office date-stamped receipt.

As agreed during the February 6 and February 7 telephone conversations with the Examiner, the U.S. Patent and Trademark Office appears to have failed to scan the document into the electronic application record the Form PTO-1449 submitted with the November 2, 2005 IDS. A copy of the Form PTO-1449 submitted with the IDS filed November 2, 2005 was faxed directly to the Examiner on February 6, 2006 in response as a stop-gap solution.

Accordingly, withdrawal of the objection is respectfully requested.

III. §102(b) Rejection Based on Saito

The Office Action rejects claims 1-4, 8, 10-13, 16, 18 and 21-24 under 35 U.S.C. §102(b) over U.S. Patent No. 6,121,634 to Saito et al. ("Saito"). This rejection is respectfully traversed.

A. Rejection of Claim 1

Independent claim 1 recites a III-V semiconductor laser diode that includes, *inter alia*, "an n-type carrier confinement layer provided on the n-side of the single or multiple quantum well active region; [and] a p-type carrier confinement layer provided on the p-side of a single or quantum well active region ... ." Saito does not include such a feature.

The Office Action asserts that p-type cladding layer 203 of Saito corresponds with the p-type carrier confinement layer recited in the claims and that the n-type cladding layer 207 corresponds to the n-type carrier confinement layer recited in the claims. This is incorrect.

(1) A Cladding Layer Does Not Inherently Act as a Current Confining Layer

In order for a layer in a semiconductor laser to act as a current confining layer, the doping level in the layer needs to be sufficiently high relative to an adjacent layer to provide the necessary band offset for the respective carriers (i.e., electrons and holes). For example, doping concentrations sufficient to produce a current confining layer, e.g., using silicon or magnesium as the doping impurity, are described in the original specification at least at paragraph [0060].

A layer may serve as a light cladding layer without acting as a current containing layer. For example, two layers with an insufficient difference in their respective doping concentrations to create a current carrier containing band may have indexes of refraction that are sufficiently different to create a reflective cladding. In such an example, light may pass through a first layer with a first index of refraction and impact upon a second layer with a significantly different index of refraction. This causes a significant portion of the light to be reflected back into the first layer. Accordingly, a cladding layer does not inherently act as a current confining layer.

(2) Saito Clearly Distinguishes Cladding Layers from Current Confining Layers

The embodiment cited by the Office Action and described in Saito at col. 8, lines 17 - col. 9, line 4, specifically states at col. 8, lines 29-30, that the embodiment includes a p-type current confining layer 208. This is the only current confining layer associated with the cited semiconductor laser embodiment shown in Saito at Fig. 6a.

In the passage cited by the Office Action in Saito (i.e., at col. 8, line 16 through col. 9, line 4 and Fig. 6A), only a **single** current confining layer is described, i.e., p-type-current confining layer 208. All of the other layers are described merely as cladding layers.

By identifying layer 208 as a current confining layer and identifying other layers as cladding layers, Saito explicitly differentiates between "current confining layers" and "cladding layers." After making such a distinction, the cited Saito embodiment and explicitly includes only a single "current confining layer."

(3) Office Action Interpretation of Saito is Improper

The Office Action ignores the distinction between cladding layers and current confinement layers made by Saito and asserts that p-type cladding layer 203 of Saito corresponds with the p-type carrier confinement layer recited in the claims and that the n-type cladding layer 207 corresponds to the n-type carrier confinement layer recited in the claims. This is improper and inconsistent with the teaching of Saito.

For example, Saito at col. 8, lines 28-31, specifically states that "208 is a **p-type** GaN current confining layer (Mg-doped, $5x10^{17}$ cm^{-3}, 0.1 μm), 209 is an **n-type** GaN contact layer (Si-doped, $1\sim3x10^{19}$ cm^{-3}, 0.1 μm), 210 is an **n-side electrode**." Further, Fig. 6a clearly shows that p-type current confinement layer 208 is on the n-side of the single or multiple quantum well active region, **not** on the p-side, as recited in the claims.

For at least the above reason, the Office Action has misconstrued and improperly applied the teaching of Saito.

(4) Saito Describes Only a P-Type Current Confining Layer

At col. 9, lines 57-64, Saito states that current confining layer 208 may be located on the other side of the active layer closer to the substrate 200, or current confining layers 208 may be provided on both sides of the active layer 205. However, **Saito describes only a**

single p-type current confining layer 208. Saito does not describe an n-type current confining layer. Accordingly, even if a current confining layer were placed on the opposite side of the active layer, given that p-type current confining layer 208 is placed on the n-side of the active layer, Saito does not teach or suggest an n-type carrier confinement layer provided on the n-side of the single or multiple quantum well active region; [and] a p-type carrier confinement layer provided on the p-side of a single or quantum well active region, as recited in the claims.

(5) Summary

For at least the reasons addressed above, Applicant respectfully asserts that the Office Action has improperly interpreted and improperly applied the Saito reference as supporting a rejection of claim 1 under 35 U.S.C. §102(b). For at least the reasons addressed above, Saito does not teach "an n-type carrier confinement layer provided on the n-side of the single or multiple quantum well active region; [and] a p-type carrier confinement layer provided on the p-side of a single or quantum well active region," as recited in the claims.

Accordingly, it is respectfully submitted that claim 1 is patentably distinguishable over the applied art. Claims 1-4, 8, 10-13, 16, 18 and 21-24 depend from independent claim 1 and are likewise patentably distinguishable over the applied art for at least their dependence on an allowable base claim, as well as for additional features they recite, such as those discussed below.

B. Claim 3 depends from Claim 1 and further recites "wherein the each of the n-type and p-type carrier confinement layers and the undoped spacing layers has an aluminum content which is about 10% to about 30% higher than an aluminum content of the quantum well active region."

As shown at col. 8, lines 22-27 of Saito, both adjacent layer 204 and 206 have the same aluminum percentage as multi-quantum well active layer 205. Therefore, Saito clearly does not disclose the above-described feature of claim 3.

C. Claim 12 Depends From Claim 1 and Further Recites "wherein various between quantum wells in the multiple quantum well active region are partially or completely Si-doped."

As stated in Saito at col. 8, lines 25-26, barriers within the active layer 205 are undoped. Accordingly, Saito does not teach or suggest the above feature.

D. Claim 21 Depends From Claim 1 and Further Recites "an n-type waveguide layer provided adjacent to the n-type carrier confinement layer."

The Office Action asserts that this feature is met by layers 208 and 207, respectively. This is incorrect at least because the claim requires that both layers be n-type layers, but in Saito, layer 208 is a p-type layer and layer 207 is an n-type layer.

E. Claim 22 Depends From Claim 21 and Further Recites "wherein each of the p-type and n-type waveguide layers comprises AlGaN with an aluminum content of about 6%."

The Office Action asserts that this feature is met by layers 202 and 208, respectively. Applicants respectfully assert that Saito does not teach or suggest such a feature. In Saito, layer 202 and layer 208 are both GaN. Neither layer includes any aluminum.

F. Claim 23 Depends From Claim 21 and Further Recites "an n-type cladding layer provided adjacent to the n-type waveguide layer."

The Office Action asserts that this feature is met by Saito's layers 209 and 208, respectively. This is incorrect at least because the claim requires that both layers be n-type layers, and Saito's layer 208 is a p-type material.

G. Claim 24 Depends From Claim 23 and Further Recites "each of the p-type and the n-type cladding layers comprises AlGaN with an aluminum content of about 13%."

The Office Action asserts that this feature is met by Saito's layers 201 and 209, respectively. This is incorrect at least because layer 201 of Saito is p-type AlN and layer 209 is n-type GaN. The claim requires that both layers be AlGaN. Further, nowhere does Saito teach or suggest an aluminum content of about 13% in either layer.

H. Conclusion

In view of the foregoing, it is respectfully submitted that claim 1 is patentably distinguishable over the applied art. Claims 1-4, 8, 10-13, 16, 18 and 21-24 depend from independent claim 1 and are likewise patentably distinguishable over the applied art for at least their dependence on an allowable base claim, as well as for additional features they recite. For example, claims 3, 12, 21, 22, 23 and 24 are distinguishable over the applied art at least for the reasons addressed above in Sections III.B - III.G, above. Accordingly, withdrawal of this rejection is respectfully requested.

IV. §102(b) Rejection Based on Matsumoto

The Office Action rejects claims 1, 2, 5-7, 9-12,16, 18, 21 and 23 under 35 U.S.C. §102(b) over European Patent No. EP908988A to Matsumoto et al. ("Matsumoto"). This rejection is respectfully traversed.

A. Rejection of Claim 1

Independent claim 1 recites a III-V semiconductor laser diode that includes, *inter alia*, "an n-type carrier confinement layer provided on the n-side of the single or multiple quantum well active region; [and] a p-type carrier confinement layer provided on the p-side of a single or quantum well active region ... ." Matsumoto does not teach or suggest such a feature.

The Office Action asserts that the n-type cladding layer 605 of Matsumoto corresponds to the n-type carrier confinement layer recited in the claims and that the p-type cladding layer 609 corresponds to the p-type carrier confinement layer recited in the claims. This is incorrect.

For reasons addressed above with respect to Saito, Applicants assert that a cladding layer does not inherently act as a current confining layer. In Matsumoto at page 15, lines 5-48, layers 603, 604 and 605 are described merely as n-type cladding layers, and layers 609, 610 and 611 are described merely as p-type cladding layers. Further, Matsumoto provides no guidance with respect to the types of dopants and/or doping concentrations that required to make the doped layers act as current confining layers.

For at least the reasons addressed above, Applicant respectfully asserts that claim 1 is patentably distinguishable over Matsumoto. Claims 2, 5-7, 9-12,16, 18, 21 and 23 depend from independent claim 1 and are likewise patentably distinguishable over the applied art for at least their dependence on an allowable base claim, as well as for additional features they recite, such as those discussed below.

B. Claim 6 Depends From Claim 5 and Further Recites "wherein the thickness of each undoped spacer layer is about 4 nm."

As stated in Matsumoto at paragraph [0146], lines 4-6, non-doped guide layers 606 and 608 are about 20 nm thick. Accordingly, Matsumoto does not teach or suggest the above feature.

C. Claim 12 Depends From Claim 1 and Further Recites "wherein barriers between quantum wells in the multiple quantum well active region are partially or completely Si-doped."

As stated in Matsumoto at paragraph [0146], line 5, the active region is undoped. This implies that any barriers within the active region are also undoped. Accordingly, Matsumoto does not teach or suggest the above feature.

D. Conclusion

In view of the foregoing, it is respectfully submitted that claim 1 is patentably distinguishable over the applied art. Claims 2, 5-7, 9-12,16, 18, 21 and 23 depend from independent claim 1 and are likewise patentably distinguishable over the applied art for at least their dependence on an allowable base claim, as well as for additional features they recite. For example, claims 6 and 12 are distinguishable over the applied art at least for the reasons addressed above in Sections IV.B - IV.C, above. Accordingly, withdrawal of this rejection is respectfully requested.

V. §102(b) Rejection Based on Seko

The Office Action rejects claims 1, 2, 5, 8-10 and 15 under 35 U.S.C. §102(e) over U.S. Patent No. 6,597,017 to Seko et al. ("Seko"). This rejection is respectfully traversed.

Independent claim 1 recites a III-V semiconductor laser diode that includes, *inter alia*, "an n-type carrier confinement layer provided on the n-side of the single or multiple quantum well active region; [and] a p-type carrier confinement layer provided on the p-side of a single or quantum well active region ... ." Seko does not teach or suggest such a feature.

The Office Action asserts at page 5, Section C, lines 5 and 6 that the N-type DBR mirror 12 and the P-type DBR mirror 16 correspond to the N-type carrier confinement layer and the P-type carrier confinement layer recited in the claims. This is incorrect.

As addressed above with respect to Saito, in Section III.A(1), in order for a layer in a semiconductor laser to act as a current confining layer, the doping levels in these layers need to be very high to provide the necessary band offset for the respective carriers (i.e., electrons and holes). For example, doping concentrations sufficient to produce a current confining

layer, e.g., using silicon or magnesium as the doping impurity, are described in the original specification at least at paragraph [0060].

Construction of the DBR mirror is addressed at col. 10, line 35 - col. 11, line 37. The DBR mirrors are formed by stacking alternate layers of $Ga_{0.9}In_{0.1}N$ and $Al_{0.5}Ga_{0.5}N$. As shown in Fig. 2, a DBR mirror may contain as many as 16 layered $Ga_{0.9}In_{0.1}N$ / $Al_{0.5}Ga_{0.5}N$ pairs to achieve a mirror with over 99% reflectance.

Nowhere in Seko is the N-type DBR mirror 12 or the P-type DBR mirror 16 described as including doping concentration sufficiently high to create a carrier confinement layer. For example, Seko describes at col. 16, lines 33-37 that efforts are taken to reduce the electric resistance of the DBR mirror. Further, as described in Seko at col. 15, lines 55-63, the P-type DBR mirror 16, on the P-side of the active region only, is subjected to proton bombardment in order to create an insulating region 17 within the P-type DBR mirror. Insulating region 17 assists with carrier confinement in that it produces a reduced current flowing region as stated at col. 15, lines 57 and 58.

Accordingly, Seko does not teach "an N-type carrier confinement layer provided on the N-side of the single or multiple quantum well active region; or a P-type carrier confinement layer provided on the P-side of the single or multiple quantum well active region," as recited in claim 1.

For at least the reasons addressed above, Applicant respectfully asserts that claim 1 is patentably distinguishable over Seko. Claims 2, 5, 8-10 and 15 depend from independent claim 1 and are likewise patentably distinguishable over the applied art for at least their dependence on an allowable base claim, as well as for additional features they recite. Accordingly, withdrawal of this rejection is respectfully requested.

VI. Conclusion

In view of the foregoing, it is respectfully submitted that this application is in condition for allowance. Favorable reconsideration and prompt allowance are earnestly solicited.

Should the Examiner believe that anything further would be desirable in order to place this application in even better condition for allowance, the Examiner is invited to contact the undersigned at the telephone number set forth below.

Respectfully submitted,

James A. Oliff
Registration No. 27,075

J. Adam Neff
Registration No. 41,218

JAO:JMH/eks

Attachment:
Copy of November 2, 2005 PTO-1449

Date: May 10, 2005

OLIFF & BERRIDGE, PLC
P.O. Box 19928
Alexandria, Virginia 22320
Telephone: (703) 836-6400

DEPOSIT ACCOUNT USE AUTHORIZATION
Please grant any extension necessary for entry;
Charge any fee due to our Deposit Account No. 24-0037